Space Weather Technical Forecast

Issued on Friday, 08 March 2024 at 01:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/Minor Storms on day 1 and 2 (08-09 Mar). Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity remains Low with the peak flare a C8.3 at 07/0618UTC from AR3599. There are six numbered and one unnumbered sunspot regions on the visible disc. AR3599, Dai/Beta-Gamma-Delta, continues to be the most magnetically complex, now with two delta regions within its intermediate portion. The remaining regions are small and generally stable with continued slight development of the small unnumbered region observed.

No Earth directed CMEs observed in available imagery, though a faint CME from near centre disk leaving the sun around 07/1300UTC is still under investigation.

Solar Wind / Geomagnetic Activity: Solar wind parameters observed by ACE/DSCOVR at L1 were at slightly elevated to slow ambient levels around 380-440km/s. Density was around average. Total magnetic field strength has been weak but on an increasing trend, with a brief peak to moderate, 8nT around 07/1830 UTC. The north-south component has varied weakly between +6nT and -7nT. Phi angle was initially mostly positive (away from the sun) but gradually negative (towards from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 2-3) with a brief period of Active (Kp 4) between 071800-2100 UTC.

Energetic Particles / Solar Radiation: GOES18 high energy (greater than 10MeV) proton flux was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels with a peak at 178pfu at 07/1605 UTC. The associated 24 hour fluence well below the Active (1e8 integrated pfu) threshold. The observed 24-hour fluence at 08/0000UTC was 1.9e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Expected to remain generally low with a chance of an isolated M-class flare.

Solar Wind / Geomagnetic Activity: A CME may give a glancing blow later on day 1 (08 Mar) or into early day 2 (09 Mar). The HSS from CH06/- should arrive at Earth later day 1 (08 Mar) and persist into day 2 (09 Mar), with solar winds perhaps reaching elevated levels. Speeds should ease later day 3 and into day 4 (10/11 Mar).

Quiet to Unsettled conditions initially. Active intervals developing later and into day 2 (09 Mar) with a chance of G1/Minor Storm intervals in association with the arrival of the HSS combined with possible effects of the glancing CME. Geomagnetic activity gradually easing through day 3 (10 Mar) and into day 4 (11 Mar), becoming Quiet.

Energetic Particles / Solar Radiation: GOES18 high energy proton flux is expected to persist at background levels. GOES16 high energy electron flux is expected to remain at mainly background levels, with the associated 24hr fluence remaining below the Active threshold.

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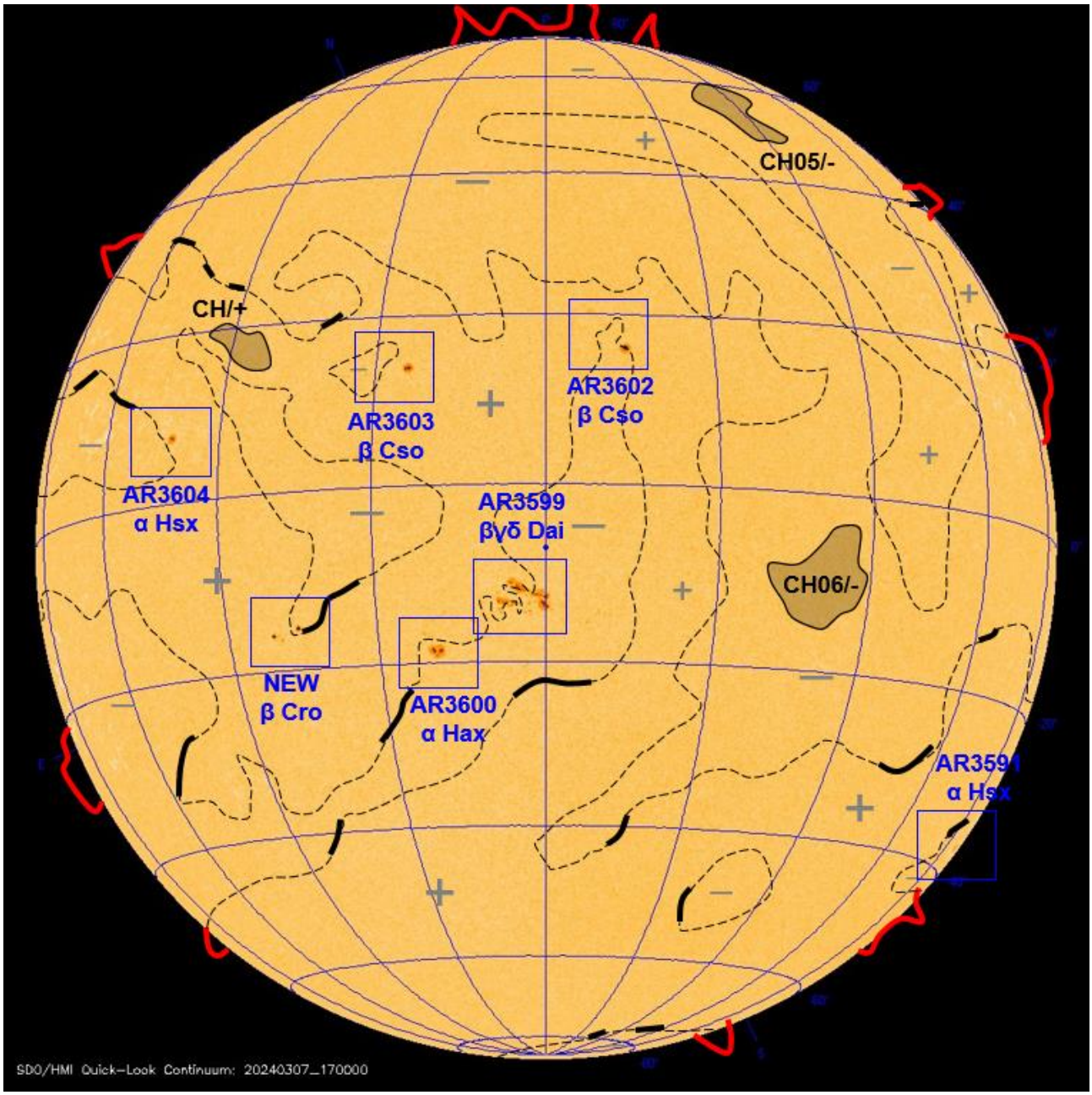
Figure 1. Solar Analysis Valid 07/1800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME, originating from filament lift off in the southeast disk on the 05 Mar, has been assessed as providing a risk of a glancing blow later on day 1 (08 Mar) or into early day 2 (09 Mar) although the majority of the CME is expected to pass below and behind Earths orbit.

Otherwise the with the next main enhancement expected from a negative polarity coronal hole, CH06/-, currently moving across the western disc. This is forecast to connect with Earth sometime later into day 1 (08 Mar) and persist into day 2 (09 Mar), with solar winds perhaps reaching elevated levels although confidence is reduced as this feature was not present on the previous rotation. Geomagnetic activity from this feature could see a greater risk for a strong connection as Earth moves closer to the March equinox.

Quiet to Unsettled conditions expected initially day 1 (08 Mar) with Active intervals developing later and into day 2 (09 Mar) with a chance of G1/Minor Storm intervals in association with the arrival of the HSS combined with possible effects of the glancing CME from the filament lift-off on the 05 March. Geomagnetic activity gradually easing through day 3 (10 Mar) and into day 4 (11 Mar), becoming Quiet.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	30	30	5	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
06/0210	Partial	Filament eruption	SE	790 km/s	09/0000 UTC	Glancing blow

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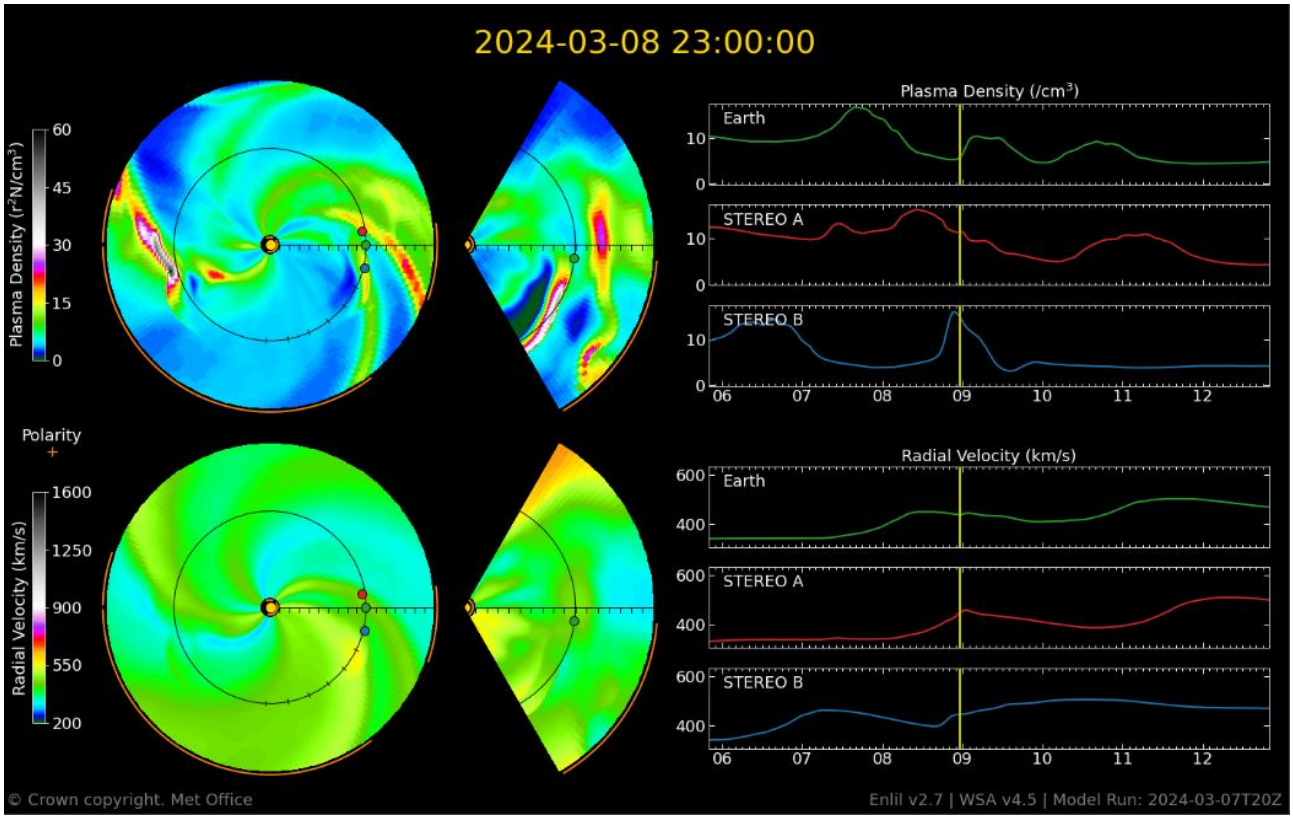
Figure 2: MOSWOC ENLIL



Radio Blackouts - X-Ray Flares:

Low activity is expected, with a chance of isolated Moderate activity maintained throughout. The current most likely source of flare activity, AR3599, remains on the visible disk throughout. Far side soundings do not currently suggest any major oncoming regions expected during the period.

There are six numbered and one unnumbered sunspot regions on the visible disc. AR3599, Dai/Beta-Gamma-Delta, continues to be the most magnetically complex, now with two delta regions within its intermediate portion. The remaining regions are small and generally stable with continued slight development of the small unnumbered region observed.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: 24 hour X-ray trace

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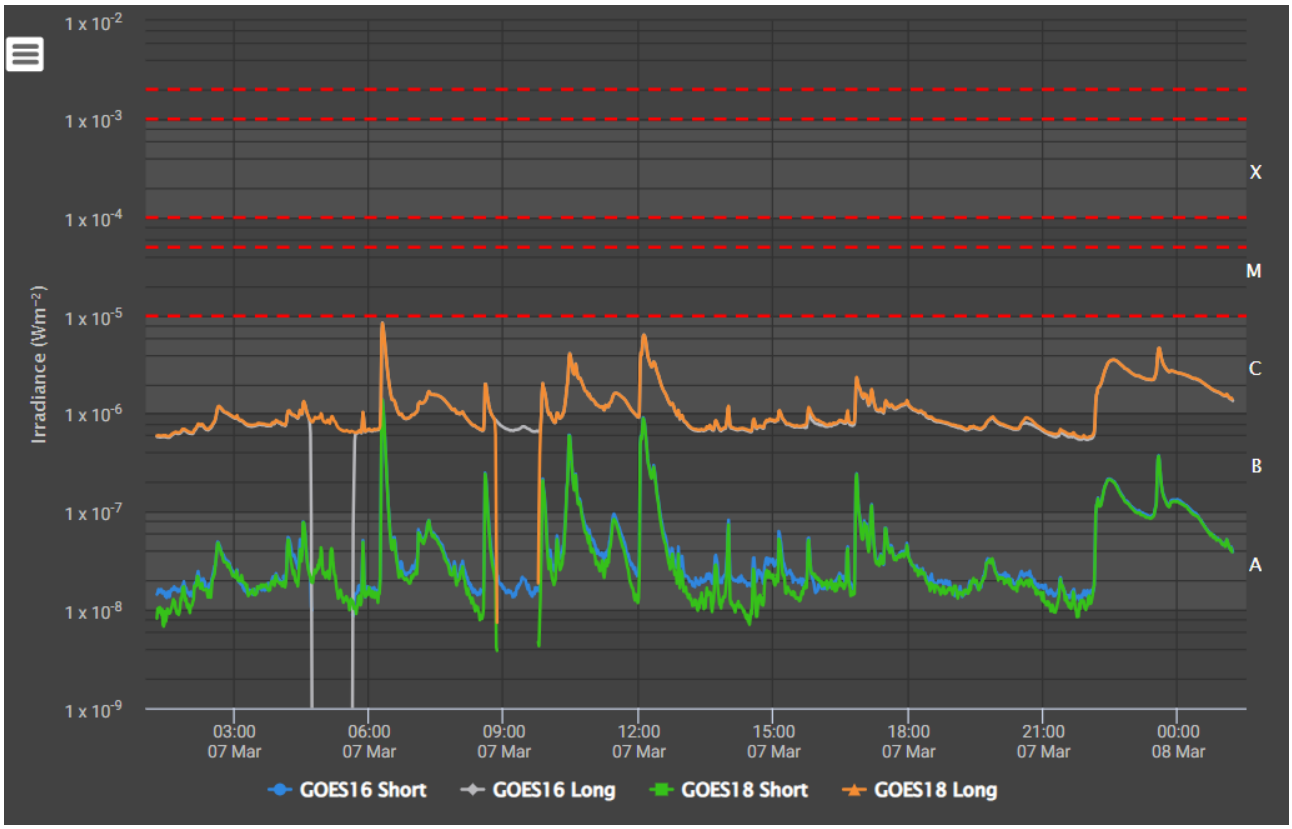

Solar Radiation Storms - (High Energy Protons):

GOES-18 proton flux is currently at background levels, and is expected to remain so through the period in the likely absence of significant western hemisphere sunspot flare activity. AR3599 is considered the only possible candidate to increase proton levels should it produce any notable flares.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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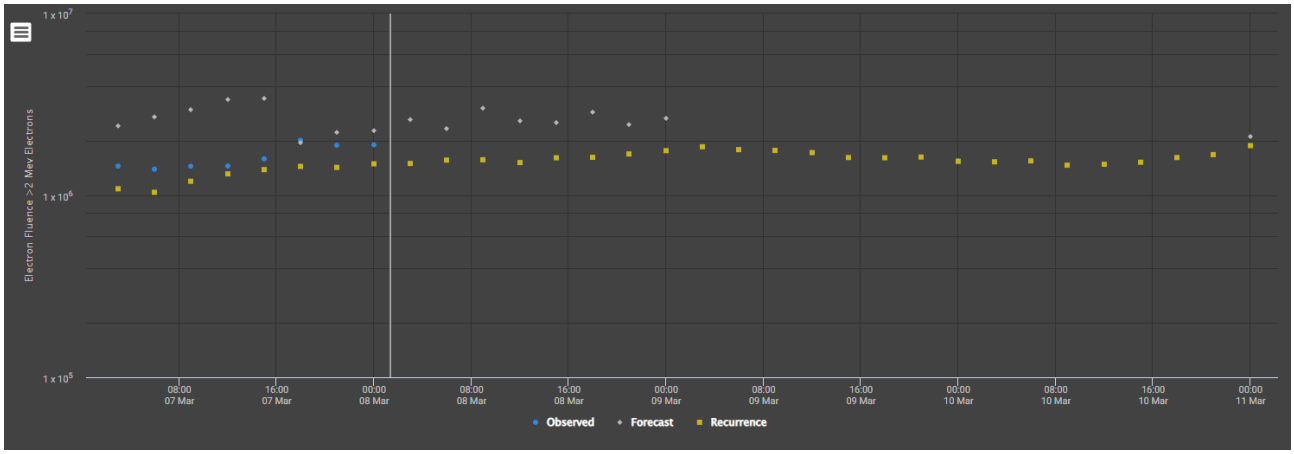
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) remains at background levels despite CME influence in recent days. and it expected to generally remain so through much of the forecast period. Any enhancement as a result of CME or coronal hole high speed stream influence are likely to be towards the end of this four-day guidance period, perhaps becoming moderate or briefly high.

Consequently, the electron fluence is expected to remain below the Active threshold, perhaps with a slight upward trend later in the period. MOSWOC REFM model output viewed as providing reasonable guidance.

GEO Electron Environment	Level ($cm^{-2}\,sr^{-1}\,day^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	10
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: MOSWOC REFM fluence forecast/observations/recurrance



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